MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

BDS4614 – MANAGEMENT DECISION SCIENCE

(All sections / Groups)

29 FEBRUARY 2020
2.30p.m. – 5.30p.m.
(3 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **SIX (6)** printed pages excluding the cover page, with **FIVE (5) questions** only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

Question 1

A small accounting firm prepares tax returns for three types of customers: individual, commercial and industrial. The tax preparation process begins with a 1 hour interview with the customer. The data collected during this interview are entered into a time-sharing computer system, which produces the customer's tax return. It takes 1 hour to enter the data for an individual customer, 2 hours for a commercial customer, and 1 ½ hours for an industrial customer. It takes 10 minutes of computer time to process an individual return, 25 minutes to process a commercial return, and 20 minutes to process an industrial return. The firm has one employee who conducts the initial interview and two who enter the data into the computer. The interviewer can work a maximum of 50 hours a week, and each of the data-entry employees can work a maximum of 40 hours a week. The computer is available for a maximum of 1025 minutes a week. The firm makes a profit of $50 on each individual customer, $65 on each commercial customer and $60 on each industrial customer.

a) Formulate the given problem as a Linear Programming Problem.

[4 marks]

b) Set up the initial simplex tableau by including the necessary slack variables.

[2 marks]

Given the following final tableau

C_j → / ↓		50	65	60	0	0	0	
	Solution Mix	X_1	X_2	X_3	S_1	S_2	S_3	*Quantity*
50	X_1	1	0	0	1	2	-0.2	5
65	X_2	0	1	0	-2	4	-0.2	15
60	X_3	0	0	1	2	-6	0.4	30
	Z_j	50	65	60	40	0	1	3025
	$C_j - Z_j$	0	0	0	-40	0	-1	

S_1 – slack for Interviewer time available

S_2 – slack for Data entry time available

S_3 – slack for Computer time available

c) How many customers of each type should the firm schedule each week in order to maximize its profit and what is the maximum profit?

[2 marks]

d) What are the shadow prices of the three constraints and explain the meaning?

[3 marks]

e) Which of the constraints are binding and explain why?

[2 marks]

f) Determine the range of optimality for the profit contribution rate of commercial customer.

[4 marks]

Continued...

g) Determine the range for the right hand side of the Data entry time constraint without changing the dual price.

[3 marks]

[Total: 20 Marks]

Question 2

The director of continuing education at a University has just approved the planning for a sales-training seminar. Her administrative assistant has identified the various activities that must be done and their relationships to each other. Because of the uncertainty in planning the new course, the assistant has also supplied the following time estimates for each activity.

Activity	Immediate Activity	Time (days)		
		Optimistic	Most Likely	Pessimistic
A	-	5	7	8
B	-	6	8	12
C	-	3	4	5
D	A	11	17	25
E	B	8	10	12
F	C,E	3	4	5
G	D	4	8	9
H	F	5	7	9
I	G,H	8	11	17
J	G	4	4	4

a) Draw a network diagram to represent the project.

[5 marks]

b) Compute the expected time and the variance for each activity time.

[4 marks]

c) Determine the critical path.

[4 marks]

d) Obtain the expected completion time for the project.

[2 marks]

e) Calculate the variance in the expected completion time for the project.

[2 marks]

f) The director wants to conduct the seminar 47 working days from now. What is the probability that everything will be ready in time?

[3 marks]

[Total: 20 marks]

Continued...

Question 3

a) A TV Box manufacturer produces TV boxes at factories located in Perlis, Penang, Pahang, and Johor. These TV boxes are then sent to distributors in Selangor, Kuala Lumpur, and Melaka. Perlis produces 300 TV Boxes each month, Penang produces 250 TV Boxes, Pahang produces 500 TV Boxes, and Johor produces 200 TV Boxes. Selangor has a demand of 600 TV Boxes each month, Kuala Lumpur needs 400 TV boxes, and Melaka needs 150 TV boxes. The shipping costs per unit (RM) are shown in the following table:

To / *From*	*Selangor*	*Kuala Lumpur*	*Melaka*
Perlis	10	9.5	12
Penang	9	8.5	10.5
Pahang	6	6	5
Johor	8	8	4

The company's goal is to find the least-cost way to meet the demands at each distribution centres.

i. How many TV boxes should be shipped from each factory to each distribution centre?

[6 marks]

ii. What is the minimum shipping cost?

[1 mark]

iii. Is there an alternative optimal shipping plan? Why? If yes, find the alternative shipping plan.

[3 marks]

b) A car service and repair workshop has four technicians. There are currently four cars in the workshop waiting for service and repair. The technicians differ in ability and experience. Thus, the hours required to service and repair the cars are different. Besides that, because of ability limitation, Jimmy is not able to fix car D. The hours required for each car by each technician are presented in the following table:

	Technician			
Car	***Meng***	***Ken***	***Danny***	***Jimmy***
A	9	7	10	11
B	7	6	8.5	8
C	9	4.5	8	9
D	6	8	7	×

Continued...

The × indicates that car D cannot be assigned to Jimmy. Find all possible assignment plans that would minimise the total time. What is the minimum total time required?

[10 marks]

[Total: 20 marks]

Question 4

Alexis Generator Technologies Company purchases a special component used in the manufacturing of automobile generators, directly from its suppliers. The generator production operation, which is operated at a constant rate, will require 1200 components per month throughout the year. Assume that the ordering costs are RM20 per order, the unit cost is RM2 per component, and annual holding costs are 20% of the value of the cost price. The company has 300 working days per year, and the lead time is 5 days.

The management at Alexis Generator Technologies plans to set their inventory policy and wants to determine the following:

a) Compute the Economic Order Quantity (EOQ) for the component.

[5 marks]

b) Based on the optimum order quantity, determine the reorder point.

[3 marks]

c) Calculate the total inventory cost based on the current ordering policy.

[7 marks]

d) Determine the time between orders.

[5 marks]

[Total: 20 Marks]

Continued...

Question 5

A company is considering expansion of its current facility to meet increasing demand. Their problem is to decide how large the expansion should be. They have constructed the following payoff table to analyze their situation in order to produce good result.

Alternative	*States of Nature*	
	High demand (RM)	*Low demand (RM)*
Major expansion	800 000	- 500 000
Minor expansion	200 000	- 100 000
Do nothing	0	0

a) What is the best decision based on maximax criterion?

[4 marks]

b) What is the best decision based on maximin criterion?

[4 marks]

c) Determine the best strategy using Equally Likely.

[4 marks]

d) Compute the criterion of realism decision and use $\alpha = 0.8$.

[4 marks]

e) What is the minimax regret decision?

[4 marks]

[Total: 20 marks]

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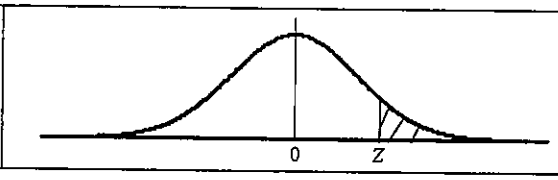
APPENDIX:

Table 1
The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000